4. DIAGNOSIS

4.1 GENERAL INFORMATION

Very often, final drive assemblies are considered as noisy, when in reality, the noise is emanating from some other source, such as tyres, front wheel bearings, rear wheel bearings, manual transmission rear bearings, engine noises, muffler roar, automatic transmission or power steering pumps.

All final drive assemblies have some slight humming noise. This will vary with the type of body construction, load and tyre pressure.

Noise which emanates from any one of these can quite easily be confused with a final drive assembly noise and unless a series of elimination tests are carried out to definitely confirm the real source of the noise, differential assemblies may be, and often are, dismantled unnecessarily.

Although not infallible, the following diagnosis guide will assist in locating and defining the different characteristics of the components which could be responsible for a noise.

Road Test

Ensure that the final drive assembly lubricant is correct and at the correct level. Drive at low speed until thoroughly familiar with vehicle noises by which time the final drive assembly should have warmed up. Accelerate gradually from the lowest practical speed in a direct ratio gear (1:1) to 100 km/h, noting any noises and the speeds at which they occur. Release the accelerator and without using the brakes, allow the vehicle to lose speed. Next, allow the vehicle to coast to rest from 100 km/h with the transmission in neutral position. Any noises common to earlier tests may be eliminated as final drive assembly gear noise, as the final drive assembly is not under load under these conditions. Engine noise is gauged by gradually accelerating the engine with the vehicle at rest.

NOTE:

Only drive at high speeds when it is legal and safe to do so.

Tyre Noise

Tyre noise can easily be mistaken for final drive assembly noise even though the noisy tyres may be operating on the front wheels. Tyre noise changes with different road conditions, but final drive assembly noise does not. Final drive assembly noise usually ceases when coasting with the transmission in neutral at speeds under 50 km/h. Tyre noise continues, but with a lower tone as vehicle speed is reduced.

Tyre noise naturally should be first eliminated; driving on a grass surface is ideal to check against this condition. It should be noted though, that dry grass can impose a fire hazard with the heat emanating from the catalytic converter and wet grass can cause excessive wheel spin. Inflating tyres temporarily to high pressures will change the contact with the road and assist in reducing tyre noise. Pressures up to 276 kPa may be used temporarily.

Tyres which have the surface of the non-skid divisions worn with one end higher than the other (saw-tooth wear) are usually noisy. Interchanging tyres can prove effective in reducing noise.

Front Wheel Bearings

Worn, brinelled, chipped or incorrectly adjusted front wheel bearings will cause a noise, very similar to tyre noise. It is a constant noise, does not vary on 'drive' or 'coast' and still persists when coasting with the transmission in neutral. This noise does not noticeably change on differing road surfaces to the same degree as does tyre noise.

Although not so pronounced, front wheel bearing noise can also be compared to a road surface noise, which is produced when the vehicle is travelling over a surface such as penetrated bitumen type road.

Transmission Rear Bearing (Manual Transmission)

A rough or pitted rear transmission bearing, usually produces a very definite bearing noise and sets up a distinct 'whirring' condition, which is most audible when accelerating from slow speed under a high throttle opening and tends to diminish as vehicle speed increases.

This noise is also prominent under a constant throttle opening, but disappears on over-run when coasting with the transmission in neutral.

When driven in second gear, noise can be amplified by lightly accelerating.

Backlash Clunk

Excessive clunk with acceleration and deceleration may be caused by worn differential pinion shafts, excessive clearance between inner axle shaft and side gear splines, drive shaft companion flange and wheel spindle flange splines, excessive clearance between side gear hub and counterbore in case, worn pinion and side gear teeth, worn thrust washers and excessive drive pinion and ring gear backlash. Remove worn parts and replace as required, selecting close fitting parts when possible. Adjust pinion and ring gear backlash.

Drive-Line Snap

A snap on sudden start, either forward or reverse, may be caused by a loose pinion flange. If loose, replace nut or flange as outlined under **2.10 PINION FLANGE** in this Section.

This condition may also be caused by incorrect lubricant in an LSD Drain and refill with correct lubricant.

Engine and Other Contributing Factors

Noises which emanate from the engine, transmission or muffler are occasionally confused with final drive assembly noises.

To isolate these noises, first carefully note the approximate vehicle speed and conditions where the supposed final drive assembly noise is most pronounced, then with the vehicle stationary and in a quiet place to avoid interfering noises (depress the clutch pedal on vehicles with manual transmission), run the engine up and down slowly through the engine speeds that correspond to the vehicle speeds at which the noise was prominent and observe whether there is any similarity to a final drive assembly noise.

For vehicles with manual transmission: With transmission still in neutral, again run the engine at similar speed while slowly letting the clutch engage, and listen for noises from the transmission.

Muffler noises are usually readily identified, possibly an exception being when a muffler emits a high-pitched periodic whistling noise, which could be confused with a bearing noise.

4.2 FINAL DRIVE ASSEMBLY NOISE

Final drive assembly noises fall into two categories:

- **a.** Gear related noises.
- **b.** Bearing related noises.

Before testing for final drive assembly noise, ensure that the lubricant is the correct type and at the correct level.

GEAR RELATED NOISE

Ring Gear and Pinion Noise

Noise produced by the ring gear and pinion set is of a cyclic nature and generally shows up as a 'drive noise', 'coast noise', or 'float noise'.

1. Drive noise is most pronounced on constant acceleration through the speed range of 50 to 90 km/h.
2. Coast noise is most pronounced when the vehicle is allowed to coast through the speed range from 90 to 50 km/h.
3. Float noise is most pronounced while the vehicle is kept at constant speed for periods between 50 to 90 km/h.

Final drive assembly noise will always change when comparing 'drive' and 'coast' and will usually cease when coasting with transmission in neutral at speeds under 50 km/h.

Differential Side Gear and Pinion Noise

Noise produced by these gears occurs when there is excessive wear between the side gear hubs and the differential case bores. This can cause a 'clunking' noise when the vehicle is driven at low speeds.

Noise produced due to excessive wear between the gear teeth will be most pronounced on turns.

Common Causes of Gear Related Noises

1. Low lubricant level or incorrect lubricant used.
2. Incorrect meshing of gear teeth (i.e. incorrect pinion positioning shim or backlash setting shims).
3. Scored gear teeth:- usually the result of incorrect lubricant type or level.
4. End play in bearings.
5. Bruised or chipped teeth.
6. Excessive runout of pinion head or ring gear backlash.
7. Ring gear creeping on differential case resulting from ring gear bolts loosening - noise from this source usually appears as a sharp metallic sound when shifting from reverse to first gear.

BEARING RELATED NOISE

Differential Pinion Gear Bearings

Worn, rough or loose bearings will tend to aggravate and magnify drive, float and coast noise, and result in heavy, irregular drive noise on constant acceleration and float, and also an irregular noise on deceleration.

Pinion bearings, if rough or brinelled, will produce a continuous whine, which will persist when coasting with transmission in neutral even to a low speed.

End play in the pinion bearings, even from natural wear, which permits the pinion to feed back into the ring gear, will cause a noise on over-run.

Drive Shaft Bearings

Drive shaft bearings that are rough or pitted can be responsible for a growling noise which on first impression could be likened to a final drive noise.

The noise, however, does not vary on 'drive' or 'coast' and still persists when coasting with transmission in neutral.

Frequently this noise can be readily identified by the sound being conveyed in an eccentric form. It can also be intermittent as the noise may fade for a short period.

To confirm the diagnosis of a drive shaft bearing noise:

1. Support the rear of the vehicle on safety stands and remove both rear wheels and brake discs.
2. Start the engine and, with top gear engaged, speed engine up to a fast idle.
3. If a stethoscope is available, it is ideal to compare the noise of one bearing against the other. To obtain the best results with a stethoscope, keep the volume adjustment down low.
4. A difference in the noise of the drive shaft bearings can also be discerned by placing a steel-shafted screwdriver to the ear and in close proximity to each bearing in turn.

With practice, a noticeable difference in noise can, at most times, be observed between a good and not so good bearing.

Differential Side Bearings

Side bearings will produce a constant grinding noise of a slower nature than pinion bearings (side bearing noise cannot be determined by the diagnosis procedure for drive shaft bearing noise), but will be in the same frequency as drive shaft bearings.

Common Causes of Bearing Related Noises

1. Low lubricant level or incorrect lubricant used.
2. Foreign matter in the lubricant.
3. Incorrect pre-load setting.
4. Bearings incorrectly mounted e.g. dirt trapped behind abutment faces during assembly.